

**Exemption No. 5765A**

**UNITED STATES OF AMERICA  
DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION  
RENTON, WASHINGTON 98055-4056**

In the matter of the petition of

**Dornier Luftfahrt GmbH**

**Regulatory Docket No. 27432**

for an exemption from § 25.562(c)(5)  
of the Federal Aviation Regulations

**PARTIAL GRANT OF EXEMPTION**

By letter LREZ-1664/93 dated December 22, 1993, Messers Krause and Gosse, Dornier Luftfahrt GmbH, 88039 Friedrichshafen, Federal Republic of Germany, petitioned for a time extension to Exemption No. 5765 from the Head Injury Criterion (HIC) of § 25.562(c)(5) of the Federal Aviation Regulations (FAR), for front row passenger seats located behind bulkheads in Dornier Model 328 airplanes, which expires on June 30, 1994.

**Sections of the FAR affected:**

Section 25.562(c)(5), as amended by Amendment 25-64, requires that each occupant must be protected from serious head injury under the dynamic test conditions prescribed in paragraph (b) of this section. Where head contact with seats or other structure can occur, protection must be provided so that the head impact does not exceed a HIC of 1,000 units. The level of HIC is defined by the equation:

$$HIC = \left[ (t_2 - t_1) \left[ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a(t) dt \right]^{2.5} \right]_{\max}$$

**Related Section of the FAR:**

Section 25.785(a), as amended by Amendment 25-64, requires that each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing must be designed so that a person making proper use of those facilities will not suffer serious injury in an emergency landing as a result of inertia forces specified in §§ 25.561 and 25.562.

**The petitioner's supportive information is as follows:**

"Dornier Luftfahrt is submitting a petition, for extension of the partial exemption granted in Exemption No. 5765 until June 30, 1994 from the requirement for a maximum Head Injury Criterion (HIC) of 1000 units of FAR 25.562(c)(5) for passenger seats located behind the cockpit/cabin bulkhead (RH) and behind the bulkhead (LH).

"1. Granting the extension of the embodiment date until Dec. 1994 would be in the public interest because the safety standard of the seats concerned is equivalent to nearly all existing airplanes in service.

"2. At the moment state-of-the-art does not enable bulkhead walls (galley, wardrobe, closet, etc.) to comply with the HIC requirement.

"3. New methods of head protection have not yet been developed for practical application. (See Aviation Safety Journal Vol. 3, No. 1, 1993 "Developments in Head Injury Protection for Airplane Passengers" by Van Gowdy, CAMI.)

"4. Granting an extension of the temporary exemption will not impede development of a technically and economically viable solution.

"5. Dornier is working together with suppliers for seats and interiors, to undertake reasonable design precautions to minimize head injury at these seats.

"6. When a technical and practical solution is available, it will be implemented in Dornier 328 production as soon as possible. Dornier 328 will also initiate work with the airlines regarding retrofit of Dornier 328 aircraft already delivered.

"7. Until implementation of a new design the safety standard of the seats concerned is equivalent to relevant seat locations in nearly all existing airplanes."

"Since the partial exemption was granted Dornier Luftfahrt GmbH has undertaken all reasonable efforts to achieve a design solution for energy absorbing pads applicable to different bulkhead types and location.

"Dornier Luftfahrt GmbH has carefully investigated the following objectives for crash pad designs:

- Different impact zones and location of bulkheads
- Energy absorbing behaviour of material combinations to obtain HIC values  $\leq$  1000 units
- Fire, smoke, toxicity requirements
- Obstruction of emergency escape paths
- Design, durability and maintenance criteria

- Stylistic integration for passenger acceptance
- Cost and weight penalties for commercial aircraft operation

"In order to meet the above specified objectives 2 tests were carried out on Oct. 26, 1993 at BURNS Aerospace test center in Winston-Salem, USA. The energy absorbing pad incorporated 3 inches of crushable material measured in direction of head impact velocity. The pad was capable of absorbing impact energy of a head mass of 7 kg at the impact velocity of 15,25 m/s. tested statically. The impact velocity was obtained from unobstructed head travel path of test 0102. Two shots were performed, 0 degrees and yawed 10 degrees, and both exceeded the HIC value of 4000.

"Since both tests have failed, Dornier Luftfahrt GmbH is no longer in the position to fulfill the time schedule granted in the exemption. Reasons for this are:

- Complexity of specified design objectives
- Lack of dynamic response data of different materials
- Long lead time for small quantities of special materials for test purposes
- Availability of test facilities
- Cost impact of dynamic tests
- Lack of research data for crash pads.

"The revised technical concept is to increase the thickness of the crash pads from 3 to 5 inches.

"Alternative concepts are also being studied, in parallel, i.e., a 3-point safety harness for the single seat on the L/H side and for the R/H double seat to increasing the distance between seat and bulkhead in order to achieve sufficient head clearance."

"The revised development, test and incorporation schedule has been established together with the passenger seat manufacturer BURNS. Based on this schedule Dornier formally requests the FAA to extend this exemption up to and including December 1994.

"In the meantime the JAA has granted extension of their partial exemption until January 1, 1995."

"Dornier Schedule for Development, Testing and the Retroactive Implementation of Seats Complying with JAR 25.562(c)(5):

- |                                       |          |
|---------------------------------------|----------|
| "1. Release of schedule.              | 12/31/93 |
| "2. Investigations and pre design on: | 01/31/94 |

## 2.1 Crash pads added to all bulkheads

### Note:

Dornier Luftfahrt will work together in this subject with Bucher Leichtbau, Switzerland. Bucher Leichtbau has almost developed a class divider with incorporated crash pad for Lufthansa. This design is under certification and has passed dynamic pendulum tests with HIC values below 1000. Dornier will base his design on the experience of Bucher Leichtbau.

## 2.2 Fixed diagonal 3-point shoulder harness for single seat LH and removal of double seat RH out of head strike envelope, alternatively.

### Note:

A diagonal belt similar to the one already dynamic qualified for the Dornier 328 observer seat will be used.

## 2.3 Front row seats with integrated diagonal shoulder harness in backrests alternatively.

### Note:

Seats with a backrest capability for belt forces are not yet available for the Dornier 328 program. A special new seat type is planned to be developed by AMP/USA for the Dornier 328 program.

## "3. Engineering principal tests for dynamic qualification 02/28/94

3.1 Crash pads will be verified on a pendulum test device using impact velocity and angle of impact from full scale head path data and a head dummy in accordance with AS 8049 at Bucher Leichtbau. A full scale sled test is planned as certification test at BURNS Aerospace, USA.

3.2 A pre production set of diagonal shoulder belt and standard seat will be sled tested at FAA, USA.

3.3 A prototype with integrated diagonal shoulder harness with a standard seat row aft of will be tested at FAA, USA.

"4. Final decision of the possible and technical most workable solution for certification. Beginning of specific design work and preparation of production drawings. 03/25/94

"5. Detailed program report about performed research and substantiation tasks provided. 04/01/94

"6. Dynamic qualification test plan (QTP) available for Airworthiness Authorities approval. 04/15/94

"7. Dynamic qualification tests. 05/11/94

"8. Test reports available, release of production drawings for retrofit parts. 05/27/94

"9. Proposals for retrofit, certification documents, and service bulletins available for Airworthiness approval. 09/01/94

"10. Approval date for retrofit solution. 10/01/94

"11. Retrofit implementation of 1st a/c. 10/05/94

"12. Retrofit implementation of last a/c. 12/31/94"

The FAA finds, for good cause, that action on this petition should not be delayed by publication and comment procedures because the grant of this petition would not set a precedent in this matter in that it only involves an extension of the compliance time of an existing exemption.

**The FAA's analysis/summary is as follows:**

The FAA issued Exemption No. 5765 on October 19, 1993, for exemption from the HIC requirement until the requested date of June 30, 1994. The exemption was granted in response to the aviation industry's reluctance to utilize existing solutions to the HIC requirement (e.g., honeycomb, various torso and shoulder restraints, increased space), and their preference instead to pursue research into what were considered to be more commercially desirable but not yet available means of compliance (i.e., "crash pads"). In order to be assured that this research would be accomplished at an acceptably progressive pace, the FAA required as a condition of that exemption that the petitioner provide the FAA with periodic progress reports of that research. To date, the FAA is not aware that the petitioner has complied with that condition. However, it is apparent from the supporting material provided with the current petition, that the petitioner has been, and continues to be, engaged in the required research activity, albeit unsuccessfully, and has more readily achievable means of compliance under review.

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest, and will not significantly affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), the petition of Dornier Luftfahrt for exemption from the HIC requirements of § 25.562(c)(5) of the FAR, for front row passenger seats located behind bulkheads on Dornier Model 328 airplanes, is granted through December 31, 1994. Other provisions of Exemption No. 5765, together with its conditions and limitations, remain the same and are applicable to this exemption. This amendment is part of, and shall remain attached to, Exemption No. 5765.

Issued in Renton, Washington, on

Robert C. McCracken  
Acting Manager,  
Transport Airplane Directorate  
Aircraft Certification Service